cell has several nuclei, and nuclear division continues after the mother cell has become recognizable, but the number of nuclei seldom exceeds a dozen. In the vegetative mitoses the chromosomes are organized directly from the reticulum, but in the tetraspore mother cell the formation of chromosomes is preceded by a typical spirem stage. After the number of nuclei reaches about a dozen, some begin to disorganize, but several may develop spirems and continue up to a typical metaphase of the heterotypic mitosis; then one nucleus continues and all the rest disorganize. The details of the division of the successful nucleus and the organization of tetraspores agrees fully with the account given by YAMANOUCHI for *Polysiphonia*.—CHARLES J. CHAMBERLAIN.

Distribution and development of an Ohio flora.—A region in southern Ohio designated as "Sugar Grove" and situated at the end of a long lobe of Merriam's Alleghenian floral area, is regarded by GRIGGS[13] as remarkable on account of its being the meeting place of many very diverse floras. He has mapped six such groups, consisting of (1) Alleghenian plants, 39 species; (2) Appalachian plants (northern), 14 species; (3) Appalachian plants (southern), 12 species; (4) Carolinian plants, 12 species; (5) Mississippian plants, 15 species, and (6) northern plants, 9 species, and finds Sugar Grove upon extreme limits of each group. The data for establishing the range of these 121 plants are scanty, as the author admits, but that many of these species are near the limit of their distribution seems quite evident. This has led to an investigation of the behavior of many species at the edges of their range,[14] and almost every possible phase of behavior is found to be exhibited. So varied appear the responses that it would seem difficult to draw any general conclusions, although the author decides that the limits of species reaching the edges of their ranges near Sugar Grove are not fixed, but are changing, and that plants of boreal affinity are apparently being displaced by others from the west and south, a continuation of the floristic movements following the glacial period. *Tsuga canadensis* is cited as an example of such movements, and GRIGGS asserts that it is now found in southern Ohio only because it has not been completely displaced by the post-glacial flora, and occupies its habitats simply because within them the invading hardwood forest has not had so good an opportunity to gain a foothold as elsewhere. This explanation seems plausible, but the reviewer cannot regard the case as proved.—GEO. D. FULLER.

Prothallium of Equisetum.—KASHYAP[15] has investigated the prothallium of *Equisetum debile* as it grows in abundance in the vicinity of Lahore, India.

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[13] GRIGGS, R. F., Observations on the geographical composition of the Sugar Grove flora. Bull. Torr. Bot. Club **40**:487–499. 1913.

[14] GRIGGS, R. F., Observations on the behavior of some species at the edges of their ranges. Bull. Torr. Bot. Club **41**:25–49. 1914.

[15] KASHYAP, SHIV R., The structure and development of the prothallium of *Equisetum debile* Roxb. Ann. Botany **28**:163–181. *figs. 45.* 1914.

This first investigated Asiatic species proves to be of great interest, as the following summary of results will show. The prothallium is exceedingly variable in its early stages, and of special interest is the occasional occurrence of a "primary tubercle" comparable to that of *Lycopodium cernuum*. The lobes of the prothallium are always erect and very close together, both in nature and in a darkened room, so that this upright position holds no relation to the amount of light. One of the striking features of the prothallium is its radial symmetry, which disposes of the claim that the fundamental difference between the prothallium of *Lycopodium* and of *Equisetum* is that the latter is not radial, but dorsiventral. The prothallium of this species also proves to be much larger than the largest that have yet been found in the genus. There are no male prothallia, but sometimes prothallia do not produce antheridia, and therefore are female. The antheridia resemble those of *Lycopodium* in position, general structure, and paraphyses. The archegonium has a single neck canal cell, which is also a feature of resemblance to *Lycopodium cernuum*. The author reaches the general conclusion that there is a clear affinity with the prothallium of *Lycopodium cernuum*, and that there is no more difference between the two prothallia than is already known to occur among the species of *Lycopodium*.—J. M. C.

The embryogeny of Balanophora.—The researches of TREUB and LOTSY on the embryogeny of the Balanophoraceae are well known. In *Balanophora* they found the four nuclei in the antipodal end of the sac, and also the synergids and egg degenerating as soon as the sac reached the fertilization stage; the remaining micropylar polar nucleus gave rise to a cellular endosperm, from one of whose cells the embryo developed.

ERNST'S studies on the embryogeny of saprophytic forms led him to suspect that there might be a simpler explanation of the origin of the embryo of *Balanophora*. A reinvestigation[16] confirmed the previous accounts of the origin and development of the embryo sac, the degeneration of the antipodals and the synergids, and the formation of a cellular endosperm from the micropylar antipodal; but it also showed that the embryo is developed from the egg. The development, however, begins late, after the egg is surrounded by cellular endosperm, and it was this behavior which misled both TREUB and LOTSY. There is no fertilization in either *Balanophora globosa* or *B. elongata*. Both are parthenogenetic. The development of the sac shows the diploid number of chromosomes.—CHARLES J. CHAMBERLAIN.

Experimentation in plant geography.—MASSART[17] has given emphasis to the fact that plant geography has hardly kept abreast of other branches of

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[16] ERNST, A., Embryobildung bei *Balanophora*. Flora **106**:129–158. *pls. 1, 2.* 1913.

[17] MASSART, J., Le role de l'éxperimentation en géographie botanique. Rec. Instit. Bot. Léo Errera **9**:68–90. 1913.